Break New Ground

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Running Oracle Database and Applications in Docker Containers on Windows

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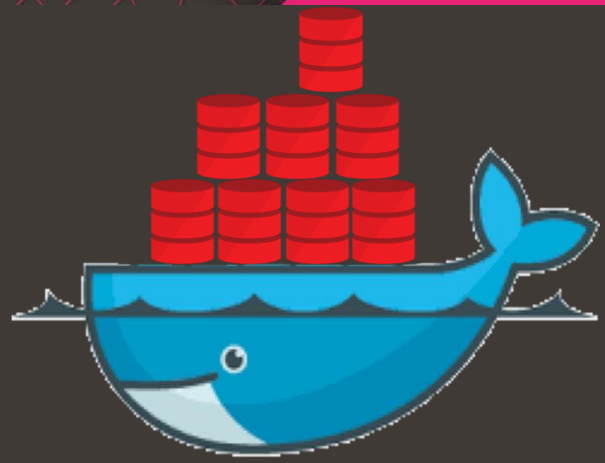
Agenda

- Introduction to Containers and Docker
- Oracle Database on Windows Containers
- Instant Client on Windows Containers
- Oracle Data Provider for .NET Core on Nano Containers

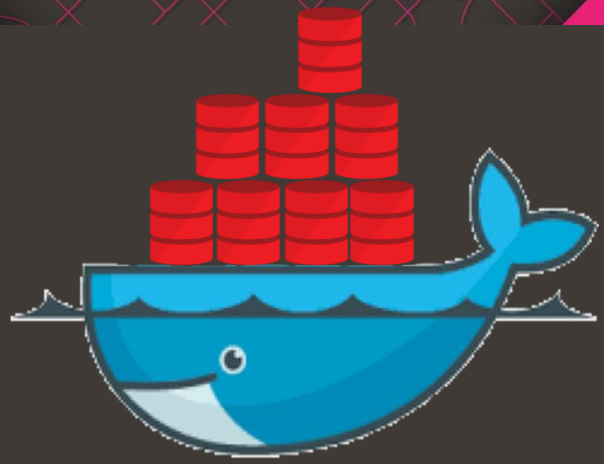
Introduction to Containers and Docker

What are Containers?



- Unlike a VM which provides hardware virtualization, a container provides operating-system-level virtualization by abstracting the “user space”
  - Containers *share* the host system’s kernel with other containers.
- Containers are lightweight (when compared to VMs)
  - No need to install Guest OS
  - Less CPU, RAM, Storage required
  - Can start up and shut down very quickly
- Provide uniformity despite differences between development and deployment

What is Docker?



- A software container platform designed for developing, shipping and running apps leveraging container tech
- Originated from Linux / Linux Containers
- Now also available on Windows and Mac OS X

Docker Terminology

- docker-engine: The host software running the containers
- Images: Collection of software to be run as a container
- Containers: A container on the host OS
- Registry: Place to store and download images
- Volumes: Place to persist data outside the container

Windows Containers: Hyper-V vs Process Level Isolation

- Process level isolation
  - Containers share the same kernel with the host, as well as each other. This is approximately the same as how containers run on Linux.
- Hyper-V isolation
  - Each container runs inside of a special virtual machine. This provides kernel level isolation between each container as well as the container host.

Docker on Windows Requirements

- Windows Server 2016 or later
  - Build 14393
  - Hyper V or Native Windows Containers
- Windows 10 :
  - Windows 10 64bit: Pro, Enterprise or Education (1607 Anniversary Update, Build 14393 or later).
  - Virtualization enabled in BIOS
  - Hyper-V enabled

Installing Docker on Windows Server

- OneGet provider PowerShell module DockerMicrosoftProvider
  - Published by Microsoft, requires elevated Powershell
  - Install-Module -Name DockerMsftProvider -Repository PSGallery –Force
  - Install-Package -Name docker -ProviderName DockerMsftProvider
  - Restart-Computer –Force
- This module also enables Windows Containers in the OS
- More details:
  - https://bit.ly/2m2YPEx

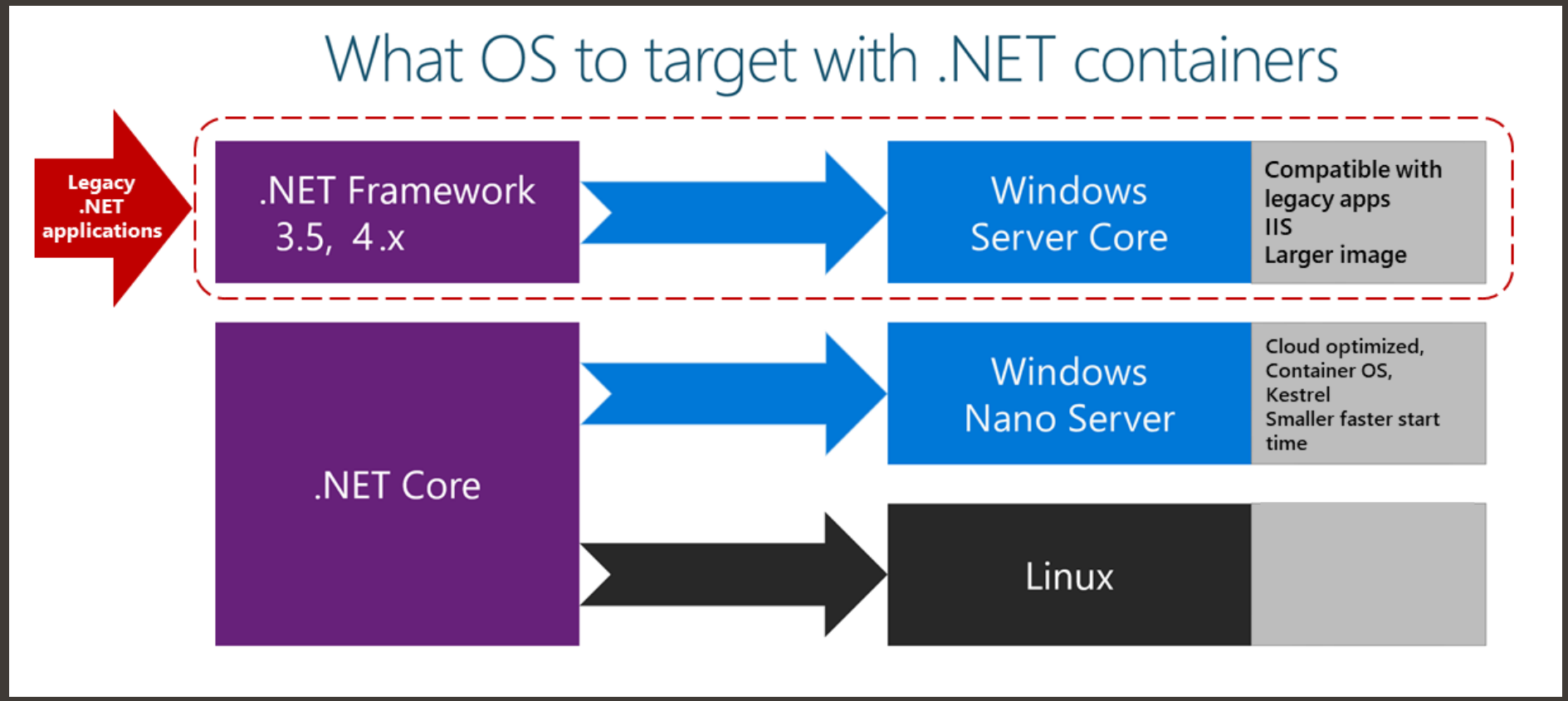
Installing Docker on Windows 10

- Download and Install Docker CE Desktop
  - https://store.docker.com/editions/community/docker-ce-desktop-windows
- After installing, switch from Linux (default) to Windows containers in menu

Images: Server Core, Nano Server, Windows

- Server Core
  - Minimalistic but includes more functionality for legacy apps (eg IIS web server)
  - Many legacy windows apps can run on it (eg Oracle Database, Oracle Client)
  - Moderate size (1.5GB compressed)
- Nano Server
  - Small and fast (100MB compressed)
  - Mostly for .NET Core applications only
  - Other executables may be built using Nano API
  - Missing many features – but MS has added important ones (Limited Powershell support)
- Windows
  - (Mostly) Full featured Windows
  - Gigantic (8+ GB uncompressed)

Server Core vs Nano Server - .NET Support



Docker on Windows Base Images

- Server Core, Nano, and Windows:
  - https://hub.docker.com/r/microsoft/windowsservercore/
  - https://hub.docker.com/r/microsoft/nanoserver/
  - https://hub.docker.com/_/microsoft-windows
- .NET Development
  - https://hub.docker.com/r/microsoft/dotnet/

Container version v Host version compatibilty

- Tight dependencies between version of host and container versions:
  - If using process isolation containers, host should be same version as container
  - If using Hyper-V containers, host should generally be newer than or same as container
  - Compatibility matrix: https://bit.ly/2JSTo5A
- Microsoft has disallowed “latest” tag due to this
  - FROM microsoft/windowsservercore:1709
  - FROM microsoft/nanoserver:1709_KB4043961
  - FROM microsoft/windowsservercore:1803
  - FROM microsoft/dotnet:2.1-aspnetcore-runtime-nanoserver-1803

Oracle Database on Windows Containers

Oracle Database on Windows Containers: How to get it working today

- Do a silent install of Oracle Database using software only install
  - Provide a response file
- Workaround required to avoid “Null pointer exception” issue:
  - Set INVENTORY_LOCATION=C:\Program Files\Oracle\Inventory in the response file
  - Bug 28747182
- Create Database
  - DBCA cannot currently run in docker containers due to bug 28747089
  - So, copy data files, or
  - Generate database create script SQL scripts with DBCA outside of container
  - Scripts have hard coded paths so make sure local drive/directories match container

Oracle Database on Windows Containers: Additional tips

- DBCA 19 no longer puts SYS/SYSTEM/PDBADMIN passwords in scripts. You may need to hard code.
- Use Virtual Account for Oracle Home User
- Allow time for Oracle Database Service to come up before running additional scripts to start listener or database
  - Eg: ping –n 121 127.0.0.1 > nul
- If issues arise, run container in interactive mode and view DBCA script output or silent install logs

Oracle Database on Windows Containers: Demo

- Windows Server 2016 running in Oracle Cloud (Compute)
- Oracle 19.3 installation package for Windows as zip file
- Response file as db.rsp
  - With INVENTORY_LOCATION fix added
- vsredist_x64.exe from
  - http://download.microsoft.com/download/0/5/6/056DCDA9-D667-4E27-8001-8A0C6971D6B1/vcredist_x64.exe
- Database Creation Assistant (DBCA) scripts or database files

Oracle Database on Windows Containers

- Windows Server 2016 running in Oracle Cloud (Compute)
- Uses Server Core base image in dockerfile:
  - FROM mcr.microsoft.com/windows/servercore:ltsc2016

Connect to the database from other containers

- Find out IP address of database container
  - From interactive shell: ipconfig
  - From host OS: Docker ps and Docker inspect container_name
- Find out Service name
  - From interactive shell: lsnrctl services
- Set up TNSNAMES.ORA and SQLNET.ORA in client
- Then connect as usual

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Database in Windows Container

Database Demo: Dockerfile

```
# Base image
FROM mcr.microsoft.com/windows/servercore:ltsc2016
#copy golden db image after taking it from OTN
COPY /WINDOWS.X64_193000_db_home.zip c:/data/db_home.zip
# unzip Oracle golden db image and install VS2013 runtime
RUN powershell -command Expand-Archive c:\\data\\db_home.zip -DestinationPath c:\\data\\db_home
RUN  setx path ".;c:\data\db_home\Bin;%path%;"
ENV ORACLE_HOME c:\\data\\db_home
COPY /vcredist_x64.exe c:/vcredist_x64.exe
#Install VS2013 runtime env
RUN powershell.exe -Command \
    $ErrorActionPreference = 'Stop'; \
    Start-Process c:\vcredist_x64.exe -ArgumentList '/install /passive /norestart ' -Wait ; \
    Remove-Item c:\vcredist_x64.exe –Force
#Provide response file to install Oracle Software Only (modified to workaround bug)
COPY db.rsp c:\\data\\db.rsp
#Execute response file to install Oracle Software Only
RUN c:\data\db_home\setup.bat -silent -responseFile c:\data\db.rsp
```


Database Demo: Dockerfile (part 2)

```
# setup the environment
ENV ORACLE_HOME c:\\data\\db_home
ENV ORACLE_SID orclcdb
ENV CLASSPATH c:\\data\\db_home\\jlib;c:\\data\\db_home\\rdbms\\jlib;
#Expose ports
EXPOSE 5500 1521
#copy dbca generated scripts to create db (may be necessary to hardcode passwords)
COPY /scripts C:/data/app/opc/admin/orclcdb/scripts
#execute scripts to create db
RUN c:/data/app/opc/admin/orclcdb/scripts/orclcdb.bat
#copy post installation scripts
COPY post_install.bat c:/data/scripts/post_install.bat
COPY startdb1.sql c:/data/scripts/startdb1.sql
COPY startdb2.sql c:/data/scripts/startdb2.sql
# Default command to start db
CMD ["c:/data/scripts/post_install.bat"]
```

Database Demo: post_install.bat

- `ping -n 121 127.0.0.1 > nul`
- `sqlplus /nolog @c:\data\scripts\startdb1.sql`
- `orapwd file=PWDorclcdb.ora password=changeoninstall11## entries=100`
- `lsnrctl start`
- `ping -n 61 127.0.0.1 > nul`
- `sqlplus /nolog @c:\data\scripts\startdb2.sql`
- `ipconfig`
- `ping -t localhost > nul`

Database Demo: startdb1.sql

- `connect sys/mypass as sysdba;`
- `alter pluggable database orclpdb open;`
- `exit;`

Database Demo: startdb2.sql

- `connect sys/mypass@localhost/orclpdb as sysdba;`
- `create user hr identified by hr;`
- `grant connect, resource, unlimited tablespace to hr;`
- `exit;`

Demo commands

- docker build -t dboow c:\dbdemo2019
- docker run –d dboow
  - In background
- docker run –it dboow
  - Interactive shell – remove last line in dockerfile

Instant Client on Windows Containers

Oracle Instant Client on Windows Container

- Use Server Core
  - Won't run on Nano Server containers
- Copy instant client zips (from OTN) and extract them
- Set path to point to Instant Client
- That's it!

Demo: Node.js and Oracle Instant Client

- Banana Farmer demo from Chris Jones' blog -- converted to Windows:
  - *A node-oracledb Web Service in Docker*
  - https://bit.ly/2NMFaB6
- Creates a web service that responds to GET, POST, PUT
  - eg GET http://172.17.0.3:3000/bananas/Gita
  - [{"SHIPMENT":"{ \"farmer\": \"Gita\", \"ripeness\": \"All Green\", \"kilograms\": 100 }"}]

Banana Farmer Demo Schema

- CREATE TABLE bananas (shipment VARCHAR2(4000) CHECK (shipment IS JSON));

- INSERT INTO bananas VALUES (
- '{ "farmer": "Gita", "ripeness": "All Green", ”kilograms": 100 }');
- INSERT INTO bananas VALUES (
- '{ "farmer": "Ravi", "ripeness": "Full Yellow", ”kilograms": 90 }');
- INSERT INTO bananas VALUES (
- '{ "farmer": "Mindy", "ripeness": "More Yellow than Green", ”kilograms": 92 }');

Node.js/Instant Client Demo dockerfile

- Copies Instant Client zip and required MSVCRT120.DLL dependency
- Automatically downloads node installation zip file
- Expands zip files
- Copies package.json and Server.js (from Chris Jones' blog)
- Npm install
- installs node-oracledb dependency listed in packages.json
- Set path to include instantclient and node.js
- Start node

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Instant Client in Windows Container

Node.js Demo: Dockerfile

```
# Base image
FROM mcr.microsoft.com/windows/servercore:ltsc2016 as builder
SHELL ["powershell", "-Command", "$ErrorActionPreference = 'Stop'; $ProgressPreference = 'SilentlyContinue';"]
ENV NODE_VERSION 8.12.0
ENV IC_FILENAME instantclient-basic-windows.x64-18.3.0.0.0dbru.zip
ENV IC_FILENAME2 instantclient-sqlplus-windows.x64-18.3.0.0.0dbru.zip
ENV IC_FOLDER instantclient_18_3
RUN Invoke-WebRequest $('https://nodejs.org/dist/v{0}/node-v{0}-win-x64.zip' -f $env:NODE_VERSION) -OutFile 'node.zip' -UseBasicParsing ; \
    Expand-Archive node.zip -DestinationPath C:\ ; \
    Rename-Item -Path $('C:\node-v{0}-win-x64' -f $env:NODE_VERSION) -NewName 'C:\nodejs';
COPY $IC_FILENAME instantclient.zip
COPY $IC_FILENAME2 instantclient2.zip
COPY msvcr120.dll c:/windows/system32/msvcr120.dll
RUN Expand-Archive instantclient.zip -DestinationPath C:\ ; \
    Expand-Archive instantclient2.zip -DestinationPath C:\ ; \
    Rename-Item -Path $($env:IC_FOLDER -f $env:NODE_VERSION) -NewName 'C:\instantclient';
```

Node.js Demo: Dockerfile (part 2)

```
RUN $env:PATH = 'C:\instantclient;C:\nodejs;{0}' -f $env:PATH ; \
 [Environment]::SetEnvironmentVariable('PATH', $env:PATH, [EnvironmentVariableTarget]::Machine)
RUN mkdir c:/demo
WORKDIR c:/demo
COPY package.json package.json
COPY server.js server.js
RUN npm install
FROM mcr.microsoft.com/windows/servercore:ltsc2016
SHELL ["powershell", "-Command", "$ErrorActionPreference = 'Stop'; $ProgressPreference = 'SilentlyContinue';"]
COPY --from=builder /nodejs /nodejs
COPY --from=builder /instantclient /instantclient
COPY --from=builder /demo /demo
COPY --from=builder /windows/system32/msvcr120.dll /nodejs/msvcr120.dll
WORKDIR c:/demo
ARG SETX=/M
RUN setx /M PATH $('C:\instantclient;C:\nodejs;'+ $Env:PATH)
CMD ["c:/nodejs/npm.cmd", "start"]
```


Oracle Data Provider for .NET Core on Nano Containers

ODP.NET Core

- Available on nuget.org
  - https://www.nuget.org/packages/Oracle.ManagedDataAccess.Core/
- Supports Windows, Oracle Linux and Red Hat Linux

Oracle Data Provider for .NET Core on Nano Server Demo

- Build .NET Core Web application in Visual Studio or command line
- “Publish” to folder
- Zip up folder
- Move zip into deployment directory

Oracle Data Provider for .NET Core on Nano Server Demo

- Pre-Build ODP.NET app, published to publish.zip
- In dockerfile:
  - FROM mcr.microsoft.com/dotnet/core/runtime:2.1-nanoserver-sac2016
  - (add command to copy and extract your zip file here)
  - COPY PUBLISH /app
  - ENTRYPOINT ["dotnet", "/app/oowdemo.dll"]
- docker run dotnetdemo

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ODP.NET Core in Nano Server

Questions?

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